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When, thirty years ago, the board was seeking a suggestive and brief name for the new journal, Edward Rand, realizing that a technical scientific journal must frequently ask for financial aid from its sponsors, suggested *Taxus*; but it became evident that such a title, staring the subscribers in the face each month, would ultimately prove detrimental to the subscription list. One reason for originally selecting the name RHODORA, was the range of the shrub bearing that colloquial name: Labrador and Newfoundland to western Quebec, south to Pennsylvania. Any well-prepared and new material on the flora of this area is obviously appropriate for RHODORA; but the geographic limits covered by the journal are elastic and, space permitting, material from outside this area will be gladly considered.

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## THE APPLICATION OF THE TERM "RHIZOME."

THEO. HOLM.

(Plates 177 and 178.)

It is a common fact that the subterranean organs of reproduction are either passed by in silence or incompletely described in Botanical



Manuals. The floral structure is, of course, the most important in such works, but characters derived from the vegetative organs of reproduction are also of importance to classification, and indeed very useful in large genera, where uniformity in floral structure is prevailing. The application of the proper terms to the various subterranean structures has also been a difficult matter, and the term rhizome, for instance, has caused great trouble to the systematists. And no wonder, because the morphologists have not, so far, come to any agreement as to its proper definition. Therefore we often see the term applied to almost any type of subterranean stems, rhizomes proper, stolons, tubers and the like; thus the diagnosis may give a wrong idea of the particular habit of some species. When, in the following pages, the writer presents some brief notes dealing with the term rhizome, it is with the intention to suggest how some improvement might be made, and with special reference to Gray's Manual.

The term has quite a history, and according to Link<sup>1</sup> Ehrhart<sup>2</sup> was the first author to employ the term for the rhizome of ferns; Link himself (l. c.) defined it as: "basis caulis intra terram demersa," and he mentions that some authors, for instance, Bernhardt and Willdenow use the term for the thicker portion of the root. Link distinguished between rhizome and tuberous stolons. Mirbel<sup>3</sup> did not use the term rhizome, but it occurs in the index of the terms as a synonym for "racine progressive," and some of the examples given are: *Gratiola officinalis*, *Polygonum bistorta*, *Convallaria polygonatum*, *Plantago major*, etc., with the important statement: "Les racines progressives sont, à proprement parler, des tiges enracinées." Seringe and Guillard<sup>4</sup> applied the term only to: "tiges souterraines et horizontales." By Lindley<sup>5</sup> rhizoma was defined as: "a prostrate thickened rooting stem, which yearly produces young branches or plants," chiefly found in *Irideae* and epiphytous *Orchideae*. According to De Candolle<sup>6</sup> a rhizome should be subterranean "caché sous terre"; *Arum*, *Nymphaea*, *Iris* and European ferns are cited as examples. Nevertheless, as early as the year 1833 the term must have been misused

<sup>1</sup> Link, H. F. *Elementa philosophiae botanicae*. Berlin, 1824, p. 129.

<sup>2</sup> Ehrhart, Fr. *Beiträge zur Naturkunde* IV, p. 44, 1787.

<sup>3</sup> Mirbel, Brisseau-C. F. *Elémens de Physiologie végétale et Botanique*. Pars 1, p. 91, Pars 2, p. 620. Paris, 1815.

<sup>4</sup> Seringe, N. C. et Guillard: *Essai de formules botaniques*. Paris, 1836, p. 116.

<sup>5</sup> Lindley, John. *An introduction to Botany*. London, 1832, p. 58.

<sup>6</sup> De Candolle, Alph. *Introduction à l'étude de la Botanique*. Vol. 1. Paris, 1835, p. 44.



to a great extent, for Bischoff<sup>1</sup> recommended to give it up altogether, having become an uncertain synonym for entirely different plant-organs. In North American manuals "rhizome" was introduced by Torrey in his flora of the State of New York (1843), and with but a few exceptions Torrey applied the term in the proper manner; these exceptions depended upon the fact that Torrey could not draw the distinction between rhizomes and stolons, notably in the case of the *Gramineae* and *Cyperaceae*. With regard to the *Orchidaceae* Torrey applied the term to *Goodyera*, but the rhizome of *Corallorrhiza* he called a root; the term "pseudo-bulb" adopted from Lindley was used for *Microstylis*, *Liparis*, *Arethusa*, etc., which shows that Torrey really observed that these plants have no bulbs in the stricter sense of the word, although described as possessing such by many systematists. With regard to *Dicentra Cucullaria* Torrey gives an excellent description viz: "Rhizome not creeping, bulbiferous, the bulbs formed of fleshy imbricated triangular scales (the thickened and persistent bases of petioles)."

It is interesting to compare this work of Torrey with that of Doell, published in the same year (1843)<sup>2</sup> because this author did not either draw any distinction between rhizomes and stolons in the case of the *Gramineae* and *Cyperaceae*; Doell, however, described the rhizome of *Corallorrhiza* in the correct manner. Very characteristic of Doell's Flora (l. c.), besides his Flora of Baden,<sup>3</sup> is the morphological treatment of the inflorescences and floral structures, notably in the *Gramineae* and *Cyperaceae*, which is far superior to that by Torrey and subsequent authors of American manuals. Morphological studies were altogether given much attention in Germany at that time; we need only to cite such fundamental works as those of Irmisch,<sup>4</sup> and Alexander Braun,<sup>5</sup> followed soon by numerous others. However, so far as concerns the definition of the subterranean stem-structures the first edition of Gray's Manual<sup>6</sup> corresponded fairly well with that given by his contemporaries. As

<sup>1</sup> Bischoff, G. W. Handbuch der botanischen Terminologie. Vol. 1, p. 124. Nürnberg, 1833.

<sup>2</sup> Doell, J. Ch. Rheinische Flora. Frankfurt a. M., 1843.

<sup>3</sup> Doell, J. Ch. Flora des Grossherzogthums Baden. Karlsruhe, 1857-1862.

<sup>4</sup> Irmisch, Thilo. Zur Morphologie der monokotylichen Knollen-und Zwiebelgewächse. Berlin, 1850.

<sup>5</sup> Braun, Alexander. Betrachtungen ueber die Erscheinung der Verjüngung in der Natur. Leipzig, 1851.

<sup>6</sup> Gray, Asa. Manual of the Botany of the Northern United States. Boston and Cambridge, 1848.



shown in the dedication of this volume to Torrey, Gray acknowledged the importance of the help he had received from this author from the commencement of his botanical pursuits. Considered in a general manner Gray adopted the terminology used by Torrey, but he used the term root-stock instead of rhizome. The definition given by Gray (l. c., p. XIV) of "rootstock or rhizoma" reads: "Usually horizontal, sending off roots from the under side or the whole surface, and advancing from year to year (being always perennial) by the growth of the bud at its apex" is not quite complete, but certainly more significant than the definition given in Gray's New Manual (1908) viz: "Any prostrate or subterranean stem, usually rooting at the node and becoming erect at the apex." Although Gray defined "tuber" as a portion of a subterranean stem, which is thickened by the deposition of nutritive matters, differing from a rhizome in being borne on a slender stalk, he described *Dicentra Cucullaria* as having a cluster of grain-like tubers, although Torrey had described this very correctly; moreover Gray called the tuberous roots of *Claytonia*, *Erigenia*, *Nabalus* and some others "tubers." Considering the early publication (1848) errors of that kind are excusable, and there are relatively only a few of them. And, when we compare the work of Grenier and Godron,<sup>1</sup> published in the same year as Gray's Manual, we must certainly admit that both Torrey and Gray had used the term rhizome or rootstock much more correctly. While the term "souche" according to Littré,<sup>2</sup> means: "le bas du tronc d'un arbre accompagné de ses racines et séparé du reste de l'arbre," this term is frequently used by French authors for herbs. For instance Grenier and Godron use "souche" for the subterranean stems producing stolons: *Epilobium*, *Sium*, *Geum*, etc., as well as for the tuber of *Arum*, and the rhizome of *Iris*, while *Acorus*, *Calla*, *Nymphaea*, etc., are described as possessing rhizomes; on the other hand, the rhizomes of *Goodyera* and *Corallorrhiza* are called "racine." In Germany the term rhizome became well defined by several authors, notably by Schacht,<sup>3</sup> and the examples he cites are characteristic: *Iris*, *Acorus*, *Convallaria*, *Corallorrhiza*, *Goodyera*, etc. At that time, we might say since 1843, morphological botany made wonderful progress, founded by Mirbel

<sup>1</sup> Grenier et Godron. Flore de France, Paris, 1848.

<sup>2</sup> Littré, E. Dictionnaire de la langue Française. Paris, 1876.

<sup>3</sup> Schacht, H. Lehrbuch der Anatomie und Physiologie der Gewächse. Pars 2. Berlin 1859. p 21.



in France, and actually continued by the Germans, and with great success. As an example of the beneficial effect, these morphological studies had on systematic botany we may cite Ascherson's *Flora*,<sup>1</sup> a work containing excellent diagnoses of the species, and with the subterranean organs correctly defined; in this work *Cirsium arvense* and *Rumex Acetosella* are described as multiplying by means of root-shoots, and not by "running rootstocks." While subsequent authors in Europe availed themselves of the profuse material brought together in the literature, the various editions of Gray's Manual were not brought "up to date," at least not with reference to the morphology of the vegetative organs. Even in the last edition (1908) there is frequently no clear distinction drawn between the various types of subterranean stems, rhizomes, tubers, stolons, etc. This is especially noticeable in the treatment of the *Orchidaceae*, where the tubers of *Pogonia trianthophora* are described as "tuberoids" = roots, where bulbs are attributed to *Calopogon*, *Arethusa*, *Microstylis* etc., although not a single member of this family possesses a bulb, but true tubers or rhizomes. In the *Gramineae* "running rootstocks" is the only characterization of the subterranean stem, although most of these are simply stolons. Furthermore "creeping rootstocks" are attributed to *Cirsium arvense* and *Rumex Acetosella*, by Irmisch correctly described as "root-shoots," and recorded as such by Ascherson (l. c.); the tuberiferous stolons of *Krigia* are called roots, while the roots of *Claytonia*, *Nabalus* and *Erigenia* are called tubers. In other words the errors committed in the first edition have not been corrected, and several others have been inserted.

Meanwhile it must be admitted that systematic works even of a more recent date do not always give the exact definition of the subterranean structures. And, moreover, it is not seldom to be seen that some of the terms, notably "rhizome," are applied to organs, which are not rhizomes, by authors of morphological works. No serious attention was given to the matter until Warming<sup>2</sup> made the suggestion, that the term "Rhizome" should be restricted to horizontal subterranean stems with short, generally thick internodes, rich in nutritive matters, and frequently with only a few roots (*Anemone nemorosa*, *Polygonatum*, *Scrophularia nodosa*, *Dentaria bulbifera*). Warming, furthermore, expressed the belief that rhizomes

<sup>1</sup> Ascherson, Paul. *Flora der Provinz Brandenburg*. Berlin, 1864.

<sup>2</sup> Warming, Eug. *Om Jordudløbere*. Kgl. Danske Vid. Selsk-Skrifter. Series 8, II, 6. Kjøbenhavn, 1918, p. 299.



most frequently represent the primary axis, developed directly from the plumule. The material studied by this author was principally of Scandinavian origin, a fact that may explain the somewhat narrow definition of the term. This suggestion that rhizomes might be restricted to the primary axis, appears to the writer as exceedingly important; we only wish to alter the expression "might be restricted" to "must in the future be restricted."—This would facilitate the proper application of the term, but would, of course, involve studies of the seedling stages in order to see the further growth of the plumule. But even if so, studies in that line would be of great value to the knowledge of the biology of the plants, especially of the North American, known but so very imperfectly from this particular point of view. With regard to the European plants, they are known so well, that the definition of the subterranean stem as a rhizome would cause no difficulty of consequence. Moreover, the various subterranean stems of the North American species may be fairly well understood by comparison with the results given in the copious literature published abroad on this subject, even if based upon material mostly European.

Before describing some examples of rhizomes of North American species, the writer wishes to refer to the literature presented some few years ago,<sup>1</sup> where the seedling-stage has been described, beside the further growth of the plumule.

We might state at once, that rhizomes may be horizontal or vertical, homogeneous or heterogeneous, monopodial or sympodial, root-bearing or rootless, the latter being only represented by *Corallorhiza* and *Hexalectris*. Although the tuber of *Arisaema*, and the bulbs of various *Liliaceae* are developed directly from the plumule, we do not include these under rhizomes, since they are so very distinctive, and should therefore be defined simply as respectively tuber and bulb; the term "corm" as exemplified by *Crocus*, *Colchicum*, *Gladiolus* and certain species of *Iris*, does not appear to be represented by any of the plants described in Gray's Manual, and will therefore be omitted. On the other hand, the distinction between rhizome, stolon and runner, difficult as it be, will be briefly touched upon in the subsequent pages.

<sup>1</sup> Holm, Theo. Hibernation and rejuvenation exemplified by North American herbs. The American Midland Naturalist. Vol. IX, 1925.



## I. HORIZONTAL, HOMOGENEOUS RHIZOMES.

*Tripsacum dactyloides* L. The seedling (fig. 2) shows the thin, primary root (R), and several relatively thick secondary roots, developed from the internodes of the primary axis. This axis is almost erect, and consists of four internodes, terminated by a vegetative growing point with a few green leaves, and with a lateral bud. In the succeeding year (fig. 3) axillary buds have developed, each with an adorsed fore-leaf or prophyllon (P), which is sharply two-keeled as shown in the cross-section (fig. 4). The growing point is still purely vegetative, and remains so until the development of the first culm; after that time a lateral bud takes its place, thus the ramification of the shoot becomes changed from a mono- to a sympodium. By the continued growth the primary axis becomes appressed to the ground, and lateral branches soon develop; thus the mature rhizome represents a tangled mass of thick, very short internodes, and bears many green leaves. The root-system is well represented, especially on the lower face of the rhizome. With the exception of the membranaceous fore-leaves all the other leaves are green, the rhizome being close to the surface of the soil, and often freely exposed to the light, at least the upper face of the axes. Similar homogenous rhizomes with all the internodes of the same thickness, and with green leaves occur also in *Acorus*, *Iris versicolor* L., *Good-ya*, *Nymphaea* and several species of *Viola*: *V. papilionacea* Pursh and its allies. More frequent, however, are rhizomes, which bear scale-like leaves preceding the aerial, green ones, as in *Uniola gracilis* Michx., *Panicum virgatum* L., *Eleocharis tenuis* (Willd.) Schult. and several other species, *Dulichium*, *Scirpus Americanus* Pers., etc., *Fuirena scirpoidea* Michx., several species of *Carex* (*Vignea*), of *Juncus*, for instance *J. scirpoides* Lam., *Smilacina*, *Polygonatum* (fig. 1), *Smilax herbacea* L., *S. tamnifolia* Michx., *Chamaelirium*, *Oakesia*, *Dioscorea* and several others. Among the *Dicotyledones* this type of rhizome is represented by *Podophyllum* (fig. 8), *Sanguinaria*, *Dentaria diphylla* Michx., and *Asarum*, but is relatively rare.

Among the rhizomes of the latter category, with scale-like leaves, are several of which the internodes are not exactly of the same thickness as, for instance, in *Polygonatum*, *Smilacina* and *Podophyllum*, where the internodes bearing the floral stems are distinctly thicker than the others, but of the same cylindric form; thus the rhizome may well be called homogeneous. Characteristic of the rhizome of *Viola*



is, that the bases of petioles and stipules persist and increase in thickness, becoming quite fleshy. In *Dentaria diphylla* the scale-leaves are quite thick and fleshy, while in the other examples mentioned these leaves are membranaceous and very thin.

There are thus some distinct forms observable in this type of rhizome: the horizontal, homogeneous, but common to all of these, except the *Viola papilionacea* alliance, is the monopodial structure until the production of the first floral stem, when the sympodium begins. As regards *Viola* the rhizome remains a monopodium throughout the life of the individual, being terminated by a rosette of leaves subtending the flowers; among the caulescent Violets this same structure recurs, for instance in *V. scabriuscula* Schwein. and *V. striata* Ait.

## II. VERTICAL, HOMOGENEOUS RHIZOMES.

This type is rare. It occurs in *Gentiana villosa* L. (fig. 7), and is relatively stout, with several thick, fusiform roots, very short internodes, and bearing only thin scale leaves. The ramification is monopodial throughout the life of the plant, and green leaves do not appear until upon the flower-bearing stem. In *Viola pedata* L. the rhizome is also relatively stout and monopodial, but all the leaves are green, forming a dense rosette with several to many axillary flowers. A corresponding, but very robust rhizome is possessed by *Symplocarpus foetidus* (L.) Nutt. In *Panax quinquefolium* L. and *P. trifolium* L. the very short rhizome is of several, short internodes bearing scale leaves, exactly alternate, and with the primary root persisting: large, fusiform in the former, small, globose in the latter species; the shoot is a monopodium until the first floral stem becomes developed. A similar, very short rhizome is exemplified by *Hepatica triloba* Chaix var. *americana* DC.; the terminal bud, purely vegetative, is surrounded by several membranaceous scale-leaves, besides that the green leaves from the preceding year's growth form a rosette around the bud. The very short rhizome, of only two to three internodes, in *Viola primulifolia* L. and *Uvularia perfoliata* L. persists only for two or three years, when axillary stolons develop and produce new individuals showing exactly the same structure as the mother plant, the primary axis. Finally in the genus *Carex* it is a marked characteristic of the grex *Lejochlaenae*, besides several species of *Dactylostachyae* that the primary axis persists for several years as a true monopodium with all the flower-bearing stems being axillary.



While thus the primary axis passes from a mono- to a sympodium after the first flowering in *Panax*, it remains a monopodium in all the other genera described, throughout the life of the shoot.

### III. HORIZONTAL, HETEROGENEOUS RHIZOMES.

An alternation of single, or series of several slender internodes with tuberous internodes makes the structure of the rhizome heterogeneous. It is a type almost confined to the *Monocotyledones*, and especially well represented in the *Orchidaceae*. The simplest structure is shown by *Dentaria laciniata* Muehl. (figs. 10-11), where the plumule at once develops into a small tuber, bearing a green leaf, and a scale-like, covering the minute, apical bud. The fully matured rhizome (fig. 11) consists of a horizontal chain of oblong tubers, separated from each other by one to two very thin internodes, each tuber representing the growth of one season. Similar to *Dentaria diphylla* Michx., the structure is monopodial until the production of the first flowering stem. It is a structure agreeing with that of *Cyclamen*, *Umbilicus*, *Eranthis* and certain species of *Corydalis* so far as concerns the development of the plumule into a tuber, but in these genera the primary tuber does not branch any further, but persists as a single tuber throughout the life of the individual. *Cardamine Douglassii* (Torr.) Britt. (fig. 6) has also a tuberous rhizome interspersed with slender internodes, but so irregularly, that the structure, mono- or sympodial, can not be determined. *Hydrophyllum Canadense* L. shows the peculiar structure of a series of relatively large, very thick and fleshy scale-leaves preceding two green leaves, which again surround another series of scale-leaves with the floral stem in the center. Very regular, and much more distinct is the rhizome of *Medeala virginiana* L. (fig. 5), where the large tuber of three internodes passes, sympodially, into a long, very slender internode terminating in another tuber.

In *Fuirena squarrosa* Michx. we observe the development of erect tubers intermixed with slender, flower-bearing shoots on a horizontal rhizome.<sup>1</sup> The growing apex of the tubers is arrested in its further development. This structure seems to be a very rare case in the *Cyperaceae*, for in this family tubers are either developed at the apex of stolons as in *Cyperus phymatodes* Muehl., *Scirpus robustus* Pursh and several other species, or they form a regular chain as in

<sup>1</sup> Holm, Theo. *Fuirena squarrosa* Michx. and *F. scirpoidea* Vahl. Am. Journ. of Sc. IV, 1897, p. 13.



*Cyperus filiculmis* Vahl., *Scleria pauciflora* Muehl., and several other species.

With regard to the *Orchidaceae* heterogeneous rhizomes represent a multitude of types, and several are well exemplified by North American genera. The study of these structures has been facilitated to a very great extent by the classic investigations of Irmisch, Pfitzer and Reichenbach, but they must be studied in nature, not in herbaria. So long as we know that neither bulbs nor corms exist in this family as shown by Pfitzer,<sup>1</sup> the matter has become very much simplified, and a brief characterization of the genera contained in Gray's Manual may be sufficient. In *Corallorrhiza odontorhiza* Nutt. the coral-like rhizome is heterogeneous, because the branch developing into an aerial, floral shoot, forms a small tuber from which the floral stem emerges. In *Corallorrhiza trifida* Chatelain, on the other hand, the non-development of this tuber makes the rhizome homogeneous as in *Hexalectris*. In *Aplectrum*, *Tipularia* and *Calypso* there is an alternation, and very regular, of tubers and slender internodes; of these the tubers are terminated by a vegetative bud, which remains dormant, thus each tuber is a monopodium, while the total rhizome represents a sympodium; furthermore in *Aplectrum* and *Calypso* a secondary rhizome is also developed in the manner exactly like that of *Corallorrhiza*, coral-like and much branched, which may be found occasionally beneath the tuber, especially in young specimens.

The tuber of *Calopogon* resembles that of *Aplectrum* and the two other genera, but the apex grows out as a small shoot with one scale-leaf, and one green leaf, surrounding the base of the terminal inflorescence; in *Aplectrum*, *Tipularia* and *Calypso* the inflorescence is axillary. In *Arethusa* the tuber consists of two internodes, of which the apical represents the base of the floral scape. A corresponding participation of the floral stem in forming the tuber recurs in *Liparis* and *Microstylis*. It might appear by a superficial glance as if "rhizome" ought not to be attributed to *Arethusa*, *Liparis* and *Microstylis*, since no slender internodes are actually visible; the tubers of these genera, however, are not single, but represent a part of a horizontal rhizome, of which the older portions are very frequently preserved, even if in a withered condition.

<sup>1</sup> Pfitzer, Ernst. Grundzüge einer vergleichenden Morphologie der Orchideen. Heidelberg, 1882.

Pfitzer, Ernst. Orchidaceae in Engler und Prantl. Die nat. Pflanzenfam Leipzig, 1888.



Finally we might mention the so-called "pseudo-rhizome" a term proposed by Nilsson.<sup>1</sup> It simply applies to a complex of persisting stem-bases, with their buds and system of roots. It is exemplified by *Phryma leptostachya* L. (fig. 12), and a number of other plants, *Collinsonia*, many *Leguminosae*, etc. But in this subterranean stem, the primary axis is not the sole one to develop into a persisting organ, but the cotyledonary shoots take also a part in its formation, and the final structure is very variable, but generally more or less tuberous. The persisting basal internodes generally show a well marked increase in thickness, and a more or less pronounced lignification of the stelar tissues.

These various structures described above, may be sufficient for defining the subterranean stems as representing a rhizome. The difficulty depends on distinguishing them from stolons, at least in the *Gramineae* and some of the *Cyperaceae*, when their origin as axillary stems can not be proved; for stolons are always axillary and subterranean; runners are also axillary, but aerial (*Fragaria*, *Antennaria*, *Erigeron*, *Cynodon*, etc.). In several genera of the *Labiatae* for instance, the stolons are terminated by tubers, and thus readily to be determined, but in the *Gramineae* and *Cyperaceae*, notably in *Carex*, the stolons may resemble rhizomes. However, it appears to be a constant character of the stolons in these families that they do not bear green leaves, only membranaceous, scale-like, as we know them from *Agrostis*, *Distichlis*, *Poa*, *Glyceria*, *Agropyrum*, *Muehlenbergia*, *Carex* and several other genera. They always show a different, internal structure from the axis that bears them, while branches of rhizomes show the same structure as the main rhizome itself. Considered at the seedling-stage the *Gramineae* and *Cyperaceae* seldom show distinctly the development of the plumule into a rhizome as shown in *Tripsacum* (fig. 2), at least not in the first or second year. In the caespitose as well as in the stoloniferous species the plumule shows some few green leaves, and the final structure, caespitose or stoloniferous, does not appear until the third or fourth year's growth, when the stolons appear, and as lateral branches from the very short, primary, erect axis. It is often difficult in these two families to decide in mature specimens whether a rhizome or stolons are present, but we must bear in mind that this particular subject has been very comprehensively treated by writers on morphology, and the litera-

<sup>1</sup> Nilsson, N. Hj. Dikotyla jordstammar. Acta Univ. Lund. Vol. 19, 1882-1883.



ture is copious. Moreover stolons are generally slender; *Triadenum* is the only genus, we know of, in which the stolons are composed of thick, fleshy internodes, thus resembling a rhizome. Further investigations of this subject are necessary, however; the object of presenting these notes was to show that the term "rhizome" when applied in the proper manner may as a vegetative structure contribute to the distinguishing of genera or species, as a character supplementary to the floral. The reason, why the writer selected Gray's Manual as a starting point for this discussion, was simply, because we consider it the standard work on American systematic botany. If a future edition of this manual would be elaborated so as to include the morphology of the vegetative organs of reproduction more completely than has been the case heretofore, it would render great assistance to the study of the North American Flora.

CLINTON, MARYLAND.

#### EXPLANATION OF PLATES 177 AND 178.

##### PLATE 177.

Fig. 1, *POLYGONATUM BIFLORUM*. Rhizome of a mature specimen; St. = base of floral stem. Fig. 2, *TRIPSACUM DACTYLOIDES*, the seedling; R. = the primary root. Fig. 3, same species, a young specimen; P. = the prophylla. Fig. 4, same species, cross-section of the prophyllon. Fig. 5, *MEDEOLA VIRGINIANA*, rhizome of mature specimen, letter as above. Fig. 6, *CARDAMINE DOUGLASSII* (Torr.) Britton, rhizome of mature specimen, letter as above. All the figures except fig. 4 are about natural size.

##### PLATE 178.

Fig. 7, *GENTIANA VILLOSA*, rhizome of mature specimen, letter as above. Fig. 8, *PODOPHYLLUM PELTATUM*, seedling in its third year, letter as above. Fig. 9, *HYDROPHYLLUM CANADENSE*, rhizome of mature specimen; L. = green leaves, St. = flowering stem. Fig. 10, *DENTARIA LACINIATA*, seedling showing the one cotyledon free (Cot.), the other enclosed in the seed; L. = the first developed leaf. Fig. 11, same species, a mature rhizome; letter as above. Fig. 12, *PHRYMA LEPTOSTACHYA*, the pseudo-rhizome of a mature specimen, letter as above. All the figures are about natural size.

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RORIPA ISLANDICA AN INVALID NAME.—Since I followed<sup>1</sup> Schinz & Thellung in taking up for *Roripa palustris* (L.) Bess. the name *R. islandica* (Oeder) Schinz & Thellung, my attention has been directed by Dr. Theodor Holm and also by Mr. Kenneth Mackenzie to the fact, overlooked by me, that the basis of Schinz & Thellung's combination is insecure, since Oeder did not unequivocally publish the binomial *Sisymbrium islandicum*, as has been asserted. Instead, Oeder

<sup>1</sup>Fernald, RHODORA, xxx. 132 (1928).